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NATIONAL DAM INSPECTION PROGRAM. STEVENS LAKE DAM (NDS-ID NUMBE--ETC(U)
JUL 80 DACW31-80-C-0020

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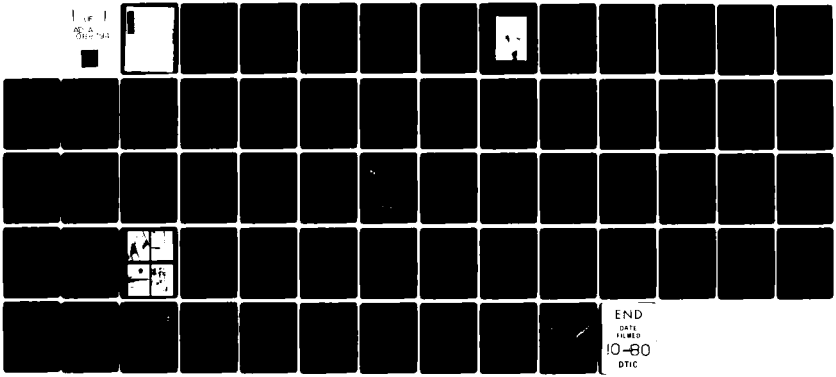

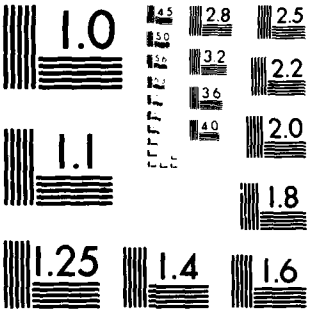

MICROCOPY RESOLUTION TEST CHART

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SUSQUEHANNA RIVER BASIN
MUD POND OUTLET, WYOMING COUNTY, Pennsylvania

PENNSYLVANIA

STEVENS LAKE DAM

Number (NDS-ID [redacted]-PA-894
DER-ID [redacted]-66-55)

PENNSYLVANIA FISH COMMISSION

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

DACW31-80-C-0020

Prepared By

L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
EBENSBURG, PENNSYLVANIA
15931

FOR

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT CORPS OF ENGINEERS
BALTIMORE, MARYLAND
21203

JULY, 1980

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in detemining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I REPORT
NATIONAL DAM INSPECTION REPORT

NAME OF DAM	Stevens Lake Dam
STATE LOCATED	Pennsylvania
COUNTY LOCATED	Wyoming
STREAM	Unnamed tributary to Lake Carey
DATE OF INSPECTION	April 8 & 9, 1980

ASSESSMENT

The assessment of Stevens Lake Dam is based upon visual observations made at the time of inspection, review of available records and data, hydraulic and hydrologic computations and past operational performance. The inspection and review of data of Stevens Lake Dam did not reveal any problems which require emergency action. The dam appears to be in good condition and adequately maintained.

Stevens Lake Dam is a high hazard-small size dam. The spillway design flood (SDF) for a dam of this size and classification is 1/2 PMF to the PMF. The PMF has been selected as the SDF based on the downstream potential for loss of life. The spillway and reservoir are capable of controlling approximately 53% of the PMF. Based on criteria established by the Corps of Engineers, the spillway is termed inadequate.

The following recommendations and remedial measures should be instituted immediately.

1. The low spot on the dam adjacent to the right spillway wingwall should be filled. A top of dam elevation of 1057.0 should be maintained.

2. Replace missing riprap on the upstream slope near the embankment crest.

3. The warning system suggested in the operational manual supplied by the Pennsylvania Fish Commission should be developed.

4. A safety inspection program should be implemented with inspections at regular intervals by qualified personnel.

STEVENS LAKE DAM
PA 894

L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS AND ARCHITECTS

Date

R. Jeffrey Kimball, P.E.

APPROVED BY:

15 August 80

Date

JAMES W. PECK
Colonel, Corps of Engineers
District Engineer

Overview of Stevens Lake Dam

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APPENDICES

PHASE I
NATIONAL DAM INSPECTION PROGRAM
STEVENS LAKE DAM
NDI. I.D. NO. PA 894
DER I.D. NO. 66-55

SECTION 1
PROJECT INFORMATION

1.1 General.

a. Authority. The National Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

b. Purpose. The purpose of the inspection is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project.

a. Dam and Appurtenances. Stevens Lake Dam is an earth-fill dam, 99 feet long and 9 feet high. The crest width of the dam is 12 feet. The upstream slope is 3H:1V and protected with handplaced riprap. The downstream slope is 2.5H:1V and is grass covered.

The spillway is located at the center of the embankment and consists of a concrete structure with a modified sharp crested weir. The spillway is equipped with wooden stop logs located along the right spillway wingwall. The 5 feet long wooden stop logs are used to regulate the level of the reservoir pool below the spillway weir elevation. The length of the weir is 52 feet long.

b. Location. The dam is located approximately 1/2 mile northwest of Lake Carey, Wyoming County, Pennsylvania. Stevens Lake Dam can be located on the Tunkhannock, U.S.G.S. 7.5 minute quadrangle.

c. Size Classification. Stevens Lake Dam is a small size dam (9 feet high, 737 ac-ft).

d. Hazard Classification. Stevens Lake Dam is a high hazard dam. Downstream conditions indicate that the loss of more than a few lives is probable should the structure fail. Several dwellings are located approximately 1/4 mile downstream and the village of Lake Carey is located approximately 1/2 mile downstream of the dam.

e. Ownership. Stevens Lake Dam is owned by the Pennsylvania Fish Commission. Correspondence should be addressed to:

Pennsylvania Fish Commission
Department of Engineering
Robinson Lane
Bellefonte, Pennsylvania 16823
(814) 359-2754

f. Purpose of Dam. Stevens Lake Dam is used for recreation.

g. Design and Construction History. Stevens Lake Dam was reconstructed during June and July, 1961, after the original dam had been washed out. There is no information available as to the circumstances surrounding the original dam washout. The new structure was built at the same location as the old strucure and incorporate portions of the breached dam. The design engineer was T.F. O'Hara, a professional registered engineer located in State College, Pennsylvania.

h. Normal Operating Procedures. The normal operating procedures as per the operation and maintenance manual supplied by the Pennsylvania Fish Commission consists of maintaining the pool elevation at approximately 1052.0 feet (spillway level).

Emergency operational procedures consists of a Wyoming County Waterways Patrolman, observing the structure on a 24 hour basis during periods of heavy precipitation. Conditions are outlined in the flood emergency operational procedure manual which would constitute a potential dam emergency. A list of appropriate personnel are contained in the manual and are to be notified in the event of a potential dam emergency. It is noted in the operation and maintenance manual that the County Civil Defense Office will develop a detailed evacuation plan which, when complete, will become part of the emergency plan.

1.3 Pertinent Data.

a. Drainage Area. 1.60 square miles

b. Discharge at Dam Site (cfs).

Maximum flood at dam site	Unknown
Drainline capacity at normal pool	None
Spillway capacity at top of dam	1748

c. Elevation (U.S.G.S. Datum) (feet). - Field survey based on principal spillway crest elevation 1052.0 feet obtained from design drawings.

Top of dam - low point	1056.7
Top of dam - design height	1057.0
Maximum pool - design surcharge	1057.0
Full flood control pool	N/A
Normal pool	1052.0
Emergency spillway crest	1052.0
Drainline	None
Maximum tailwater	Unknown
Toe of dam	1047.3

d. Reservoir (feet).

Length of maximum pool (PMF)	5400 feet
Length of normal pool	4000 feet

e. Storage (acre-feet).

Normal pool	390
Top of dam	737

f. Reservoir Surface (acres).

Top of dam	91
Normal pool	72
Spillway crest	72

g. Dam.

Type	Earthfill
Length	99 feet
Height	9 feet
Top width	12 feet
Side slopes - upstream	3H:1V
- downstream	2.5H:1V
Zoning	None
Impervious core	None
Cutoff	None
Grout curtain	None

h. Reservoir Drain.

Type	Removable stop logs
Length	Not applicable
Closure	Not applicable
Access	At spillway crest
Regulating facilities	Removable stop logs

i. Spillway.

Type	Modified sharp crested concrete weir
Length	52 feet
Crest elevation	1052.0
Upstream channel	Lake (Unrestricted)
Downstream channel	Natural streambed

SECTION 2
ENGINEERING DATA

2.1 Design. Review of information in the files of the Commomwealth of Pennsylvania, Department of Environmental Resources revealed that some correspondence, design drawings, and permit information were available for review. Information was supplied by personnel from the Pennsylvania Fish Commission who accompanied the inspection team during the inspection. Design drawings and an engineering report prepared by Thomas O'Hara, Chief Engineer of the Fish Commission, were reviewed at the time of inspection. Mr. Jon Grindall and two associates accompanied the inspection team during the inspection of Stevens Lake Dam.

2.2 Construction. Stevens Lake Dam was constructed during June and July of 1961. No other information is available on construction of the dam.

2.3 Operation. No operations are conducted at the dam.

2.4 Evaluation.

a. Availability. Engineering data were provided by PennDER, Bureau of Dams and Waterway Management. The owner of the dam is the Pennsylvania Fish Commission. A representative of that organization accompanied the inspection team during the inspection of the dam and was interviewed in regards to operation and maintenance of the dam.

b. Adequacy. The Phase I Report was based on visual inspection and hydrologic and hydraulic analysis. Sufficient information exists to complete a Phase I Report.

SECTION 3
VISUAL INSPECTION

3.1 Findings.

a. General. The onsite inspection of Stevens Lake Dam was conducted by personnel of L. Robert Kimball and Associates on April 8 & 9, 1980. The inspection consisted of:

1. Visual inspection of the retaining structure, abutments and toe.
2. Examination of the spillway facilities, exposed portion of any outlet works and other appurtenant works.
3. Observations affecting the runoff potential of the drainage basin.
4. Evaluation of the downstream area hazard potential.

b. Dam. The dam appears to be in good condition. From a brief survey conducted during the inspection, it was noted that a low spot exists on the embankment crest adjacent to the right spillway wingwall. The crest and downstream slope of the dam was grass covered. The crest width is 12 feet. The downstream slope was measured to be 2.5H:1V and the upstream slope 3H:1V. Riprap exists on the upstream slope for protection. A small section of the riprap near the crest of the dam was missing.

c. Appurtenant Structures. The concrete structure, the spillway weir and the stop logs appeared to be in good condition. The spillway for Stevens Lake Dam maintains a water level of approximately 1052.0 feet.

d. Reservoir Area. The watershed consists almost equally of forested land as well as farmland. Several swamps are located within the watershed, but did not appear to be capable of storing any substantial amount of water. The reservoir slopes are gentle to moderate and do not appear to be susceptible to massive landslides which would affect the storage volume of the reservoir or cause overtopping of the dam by displacing water.

e. Downstream Channel. The downstream channel of Stevens Lake Dam is relatively narrow for a distance of 1/2 mile until it reaches the village of Lake Carey. At this point the area widens and all discharges enter Lake Carey.

3.2 Evaluation. The embankment appeared to be in good condition. The spillway and stop log assembly appear to be in good condition. No visible seepage was observed during the inspection.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Procedures. Water level is maintained at the spillway crest elevation, 1052.0.

4.2 Maintenance of the Dam. A planned maintenance schedule exists for Stevens Lake Dam. A maintenance checklist is provided in the operation and maintenance manual supplied by the Pennsylvania Fish Commission. The maintenance schedule was reviewed and appears to be adequate.

4.3 Maintenance of Operating Facilities. No operations are conducted at the dam. Stop logs are present in the spillway weir and are used to drain the lake on an as-need basis. The stop logs appear to be in good condition and well maintained.

4.4 Warning System in Effect. The operation and maintenance manual prepared for this dam contains a statement to the effect that the County Civil Defense Office will develop a detailed evacuation plan which, when completed, will become part of the manual.

4.5 Evaluation. The condition of the dam is considered good. There was no warning system in effect to warn downstream residents at the time of inspection. A warning system is in the planning stages.

SECTION 5
HYDRAULICS AND HYDROLOGY

5.1 Evaluation of Features.

a. Design Data. The DER files did not contain any hydrologic or hydraulic design calculations used in design of these facilities. Some hydraulic and hydrologic data were supplied by the Pennsylvania Fish Commission and were reviewed for the purposes of this report. Information supplied by the Fish Commission consisted of some preliminary calculations used in the design of the spillway crest. The design calculations and drawings show the spillway length to be 52 feet. This agrees with data collected during the time of the inspection.

b. Experience Data. No rainfall, runoff or reservoir level data were available. Information supplied by the Pennsylvania Fish Commission suggests that the original dam was washed out but no date was associated with the washout. The dam was rebuilt in 1961. The new spillway has reportedly functioned adequately in the past.

c. Visual Observations. The spillway appeared to be in good condition. A low point exists on the dam crest adjacent to the right spillway wingwall. Flow over this low point would cause some erosion to the right embankment section. No erosion was noted during the inspection.

d. Overtopping Potential. Overtopping potential was investigated through the development of the probable maximum flood (PMF) for the watershed and the subsequent routing of the PMF and fractions of the PMF through the reservoir and spillway.

The Corps of Engineers, Baltimore District, has directed that the HEC-1 Dam Safety Version systemized computer program be utilized. The program was prepared by the Hydrologic Engineering Center (HEC), U.S. Army Corps of Engineers, Davis, California, July, 1978. The major methodologies or key input data for this program are discussed briefly in Appendix D.

5.2 Evaluation Assumptions. To enable completion of the hydraulic and hydrologic analysis for this structure, it was necessary to make the following assumptions.

1. Pool elevation prior to the storm was at the spillway crest elevation, 1052.0.

2. The several swamp areas located in the watershed were not considered as being capable of storing any significant amount of inflow.

3. The top of dam was considered the low spot elevation, 1056.7.

5.3 Summary of Overtopping Analysis. Complete summary sheets for the computer output are presented in Appendix D.

Peak inflow (PMF)	4670 cfs
Spillway capacity	1748 cfs

a. Spillway Adequacy Rating. The Spillway Design Flood (SDF) for a dam of this size and classification is in the range of 1/2 PMF to PMF. The SDF for this dam was selected to be the PMF based on the downstream potential for loss of life. Based on the following definition provided by the Corps of Engineers, the spillway is rated as inadequate as a result of our hydrologic analysis.

> Inadequate - All high hazard dams which do not pass the spillway design flood (PMF).

The spillway and reservoir are capable of controlling approximately 53% of the PMF without overtopping the embankment.

5.4 Summary of Dam Breach Analysis. As the subject dam is capable of passing 50% of the PMF it was not necessary to perform the dam breach analysis and downstream routing of the flood wave.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability.

a. Visual Observations. No erosion was observed on the embankment crest or slopes at the time of the inspection. The embankment slopes were wet due to overnight rainfall which occurred prior to the inspection. No seepage was observed during the inspection. No structural deficiencies were observed during the time of the inspection and the embankment appeared to stable. The Pennsylvania Fish Commission's operation and maintenance manual suggest that the crest, slopes and toe area be inspected monthly. No problems have been reported as a result of the monthly inspections.

b. Design and Construction Data. No design or construction data were available in the DER files. Review of design information supplied by the Pennsylvania Fish Commission did not contain any information relative to a stability analysis on this dam.

c. Operating Records. No operations are conducted at the dam.

d. Post Construction Changes. No post construction changes are known to have occurred since the structure was rebuilt in 1961.

e. Seismic Stability. The dam is located in seismic zone 1. No seismic stability analyses has been performed. Normally, it can be considered that if a dam in this zone is stable under static loading conditions, it can be assumed safe for any expected earthquake loading. Since no signs of instability were noted during the inspection, Stevens Lake Dam is assumed to be safe for earthquake loading.

SECTION 7
ASSESSMENT AND RECOMMENDATIONS/REMEDIAL MEASURES

7.1 Dam Assessment.

a. Safety. The dam appears to be in good condition and adequately maintained. No erosion or seepage were observed during the inspection. A section of riprap is missing on the upstream slope near the embankment crest. The visual observations, review of available data, hydrologic and hydraulic calculations and past operational performance indicate that the Stevens Lake Dam is capable of controlling 53% of the PMF. The low spot on the embankment crest should be filled to the top of dam elevation 1057.0.

b. Adeqacy of Information. Sufficient information is available to complete a Phase I Report.

c. Urgency. The recommendations suggested below should be implemented immediately.

d. Necessity for Further Investigation. No further investigations are required.

7.2 Recommendations/Remedial Measures.

1. The low spot on the dam adjacent to the right spillway wingwall should be filled. A top of dam elevation of 1057.0 should be maintained.

2. Replace missing riprap on the upstream slope near the embankment crest.

3. The warning system suggested in the operational manual supplied by the Pennsylvania Fish Commission should be developed.

4. A safety inspection program should be implemented with inspections at regular intervals by qualified personnel.

APPENDIX A
CHECKLIST, VISUAL INSPECTION, PHASE I

CHECK LIST
VISUAL INSPECTION
PHASE I

NAME OF DAM Stevens Lake Dam COUNTY Wyoming STATE Pennsylvania ID# PA 894

TYPE OF DAM Earthfill HAZARD CATEGORY High

DATE(s) INSPECTION April 8,9, 1980 WEATHER Overcast and cool TEMPERATURE 50°

POOL ELEVATION AT TIME OF INSPECTION 1052.2 M.S.L. TAILWATER AT TIME OF INSPECTION 1047.3 M.S.L.

INSPECTION PERSONNEL:

R. Jeffrey Kimball, P.E. - L. Robert Kimball and Associates

James T. Hockensmith - L. Robert Kimball and Associates

O.T. McConnell - L. Robert Kimball and Associates

Jon Grindall - Pennsylvania Fish Commission

Danny O'Neil - Pennsylvania Fish Commission

James T. Hockensmith RECORDER

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	None.	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Appeared adequate.	
RIPRAP FAILURES	Small section of riprap missing on upstream slope near crest of dam.	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
VEGETATION	Crest and slopes grass covered.	
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Appears to be good.	
ANY NOTICEABLE SEEPAGE	Due to inclement weather and overnight rainfall prior to inspection no evaluation of seepage was possible.	
STAFF GAUGE AND RECORDER	None.	
DRAINS	None.	

CONCRETE/MASONRY DAMS - Not applicable

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
ANY NOTICEABLE SEEPAGE		
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS		
DRAINS		
WATER PASSAGES		
FOUNDATION		

CONCRETE/MASONRY DAMS - Not applicable

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES		
STRUCTURAL CRACKING		
VERTICAL AND HORIZONTAL ALIGNMENT		
MONOLITH JOINTS		
CONSTRUCTION JOINTS		
STAFF GAUGE OR RECORDER		

OUTLET WORKS
(Stop log slot in spillway)

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	Not applicable.	
INTAKE STRUCTURE	Not applicable.	
OUTLET STRUCTURE	Not applicable.	
OUTLET CHANNEL	Not applicable.	
EMERGENCY GATE	Not applicable.	

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Modified sharp crest. The weir appeared to be in good condition and well maintained.	
APPROACH CHANNEL	Unrestricted - lake.	
DISCHARGE CHANNEL	Natural stream.	
BRIDGE AND PIERS	None.	

GATED SPILLWAY - Not applicable

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL		
APPROACH CHANNEL		
DISCHARGE CHANNEL		
BRIDGE AND PIERS		
GATES AND OPERATION EQUIPMENT		

DOWNSTREAM CHANNEL

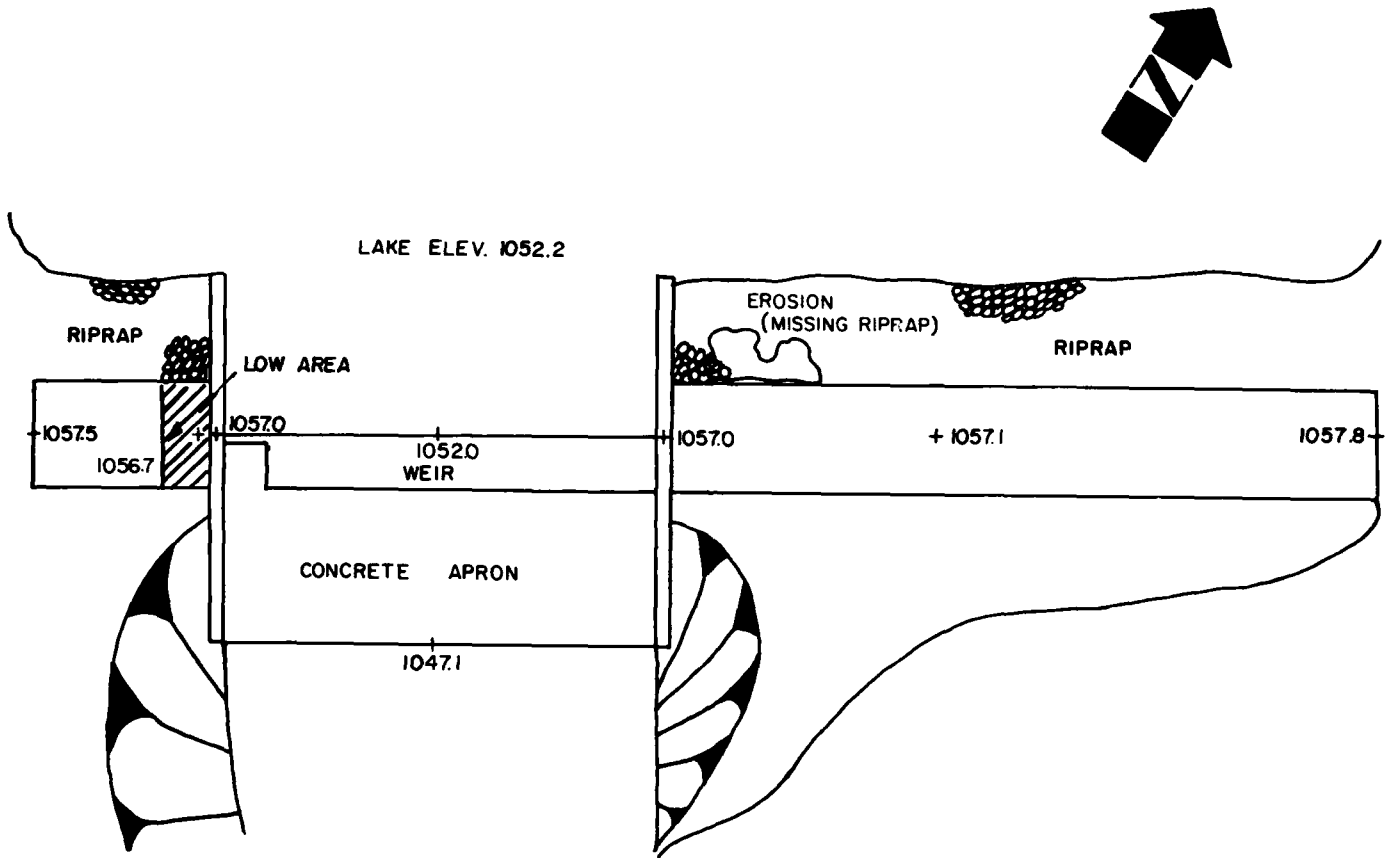
VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Narrow channel for a distance of approximately 1/2 mile to the village of Lake Carey. Area flattened for the remaining distance to Lake Carey.	
SLOPES	Appear to be stable.	
APPROXIMATE NO. OF HOMES AND POPULATION	Approximately 6 homes/25 people within 1 mile of the dam.	

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Gentle to moderate slopes. Appear to be stable.	
SEDIMENTATION	Unknown.	

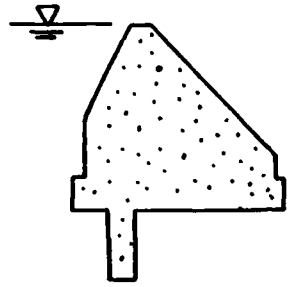
INSTRUMENTATION

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None.	
OBSERVATION WELLS	None.	
WEIRS	None.	
PIEZOMETERS	None.	
OTHER	None.	

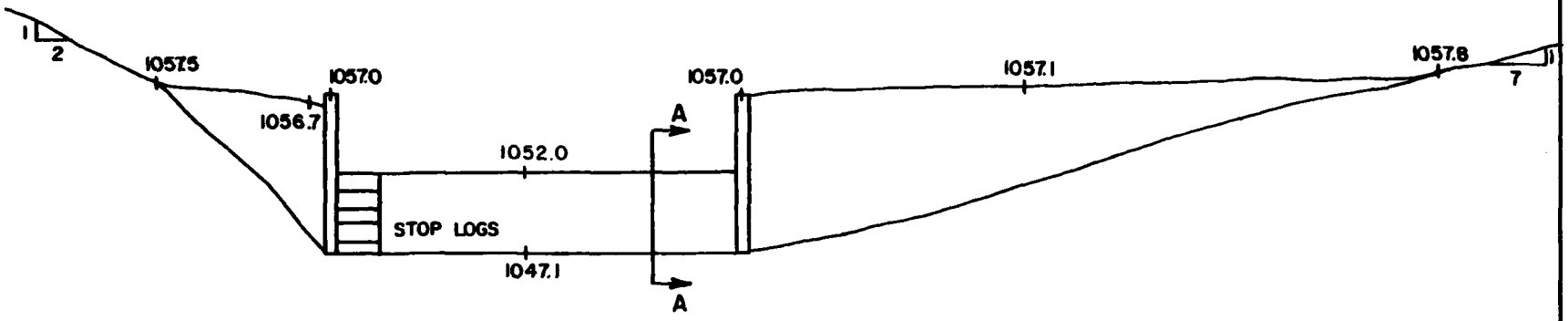


STEVENS LAKE DAM

(Scale 1" = 20')



SPILLWAY CREST
SECTION A-A
(Not To Scale)



PROFILE
LOOKING UPSTREAM
Scale: Horiz. 1" = 20'
Vert. 1" = 10'

STEVENS LAKE DAM

APPENDIX B
CHECKLIST, ENGINEERING DATA, DESIGN, CONSTRUCTION, OPERATION, PHASE I

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM Stevens Lake Dam

ID# PA 894

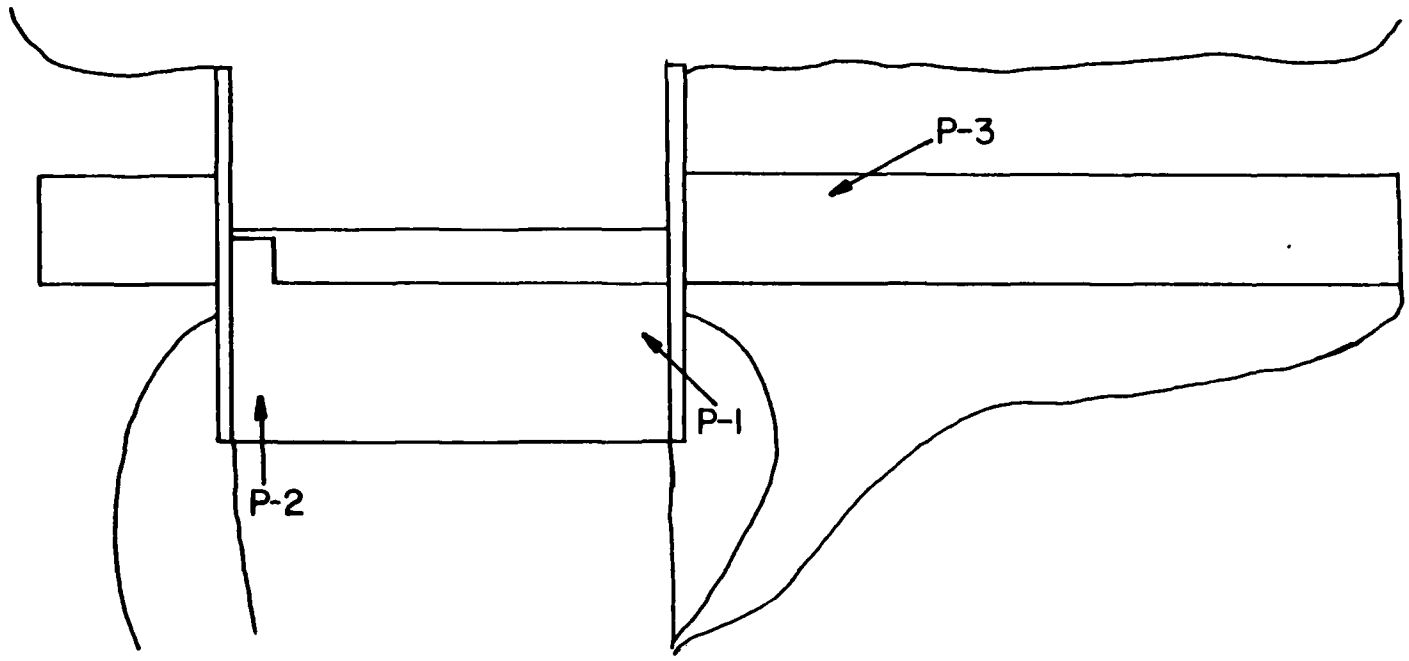
ITEM	REMARKS
AS-BUILT DRAWINGS	Unknown.
REGIONAL VICINITY MAP	U.S.G.S. quadrangle.
CONSTRUCTION HISTORY	Owner interviewed.
TYPICAL SECTIONS OF DAM	On construction drawings.
OUTLETS - PLAN - DETAILS - CONSTRAINTS - DISCHARGE RATINGS RAINFALL/RESERVOIR RECORDS	None. None. None. None. None.

ITEM	REMARKS
DESIGN REPORTS	Pennsylvania Fish Commission.
GEOLOGY REPORTS	Unknown.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	Pennsylvania Fish Commission.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	Unknown.
POST-CONSTRUCTION SURVEYS OF DAM	None.
BORROW SOURCES	Pennsylvania Fish Commission files.

ITEM	REMARKS
MONITORING SYSTEMS	None.
MODIFICATIONS	None since reconstruction in 1961.
HIGH POOL RECORDS	None.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	Original dam washed out. No date associated with failure.
MAINTENANCE OPERATION RECORDS	Pennsylvania Fish Commission files.

ITEM	REMARKS
SPILLWAY PLAN SECTIONS DETAILS	Construction drawings, Pennsylvania Fish Commission files.
OPERATING EQUIPMENT PLANS & DETAILS	None.

APPENDIX C
PHOTOGRAPHS



P-INDICATES PHOTO LOCATION

STEVENS LAKE
PHOTO INDEX

STEVENS LAKE DAM
PA 894

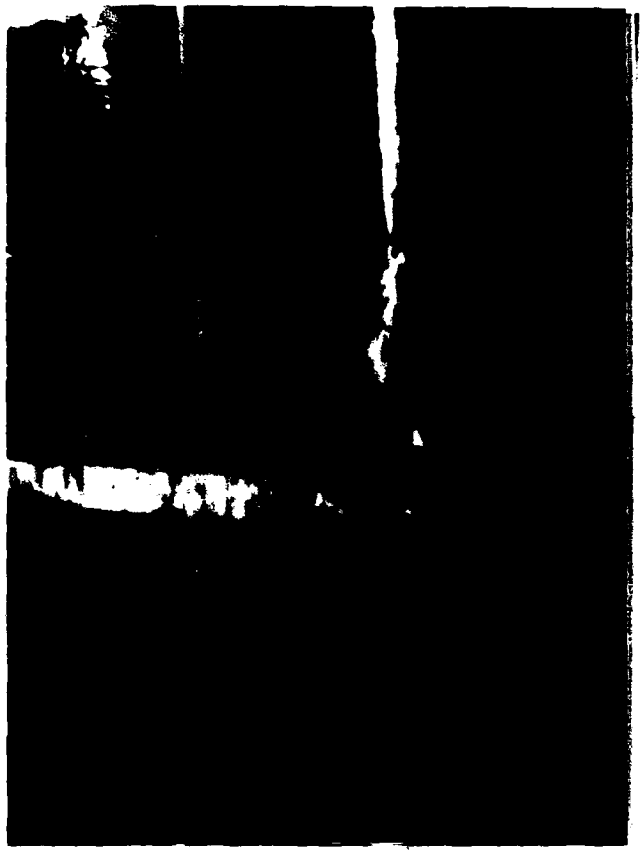
Photograph Descriptions

Sheet 1. Front

(1) Upper left - Spillway at Stevens Lake Dam.
(2) Upper right - Stop logs in weir section.
(3) Lower left - Missing riprap upstream slope.
(4) Lower right - Downstream exposure.

TOP OF PAGE

1	2
3	4



APPENDIX D
HYDROLOGY AND HYDRAULICS

APPENDIX D
HYDROLOGY AND HYDRAULICS

Methodology. The dam overtopping and breach analyses were accomplished using the systemized computer program HEC-1 (Dam Safety Investigation), September, 1978, prepared by the Hydrologic Engineering Center, U.S. Army Corps of Engineers, Davis, California. A brief description of the methodology used in the analysis is presented below.

1. Precipitation. The Probable Maximum Precipitation (PMP) is derived and determined from regional charts prepared from past rainfall records including "Hydrometeorological Report No. 40" prepared by the U.S. Weather Bureau.

The index rainfall is reduced from 10% to 20% depending on watershed size by utilization of what is termed the HOP Brook adjustment factor. Distribution of the total rainfall is made by the computer program using distribution methods developed by the Corps.

2. Inflow Hydrograph. The hydrologic analysis used in development of the overtopping potential is based on applying a hypothetical storm to a unit hydrograph to obtain the inflow hydrograph for reservoir routing.

The unit hydrograph is developed using the Snyder method. This method requires calculation of several key parameters. The following list gives these parameters their definition and how they were obtained for these analysis.

Parameter	Definition	Where Obtained
Ct	Coefficient representing variations of watershed	From Corps of Engineers*
L	Length of main stream channel miles	From U.S.G.S. 7.5 minute topgraphic
Lca	Length on main stream to centroid of watershed	From U.S.G.S. 7.5 minute topographic
Cp	Peaking coefficient	From Corps of Engineers*
A	Watershed size	From U.S.G.S. 7.5 minute topographic

*Developed by the Corps of Engineers on a regional basis for Pennsylvania.

3. Routing. Reservoir routing is accomplished by using Modified Plus routing techniques where the flood hydrograph is routed through reservoir storage. Hydraulic capacities of the outlet works, spillways and the crest of the dam are used as outlet controls in the routing.

The hydraulic capacity of the outlet works can either be calculated and input or sufficient dimensions input and the program will calculate an elevation discharge relationship.

Storage in the pool area is defined by an area - elevation relationship from which the computer calculates storage. Surface areas are either planimetered from available mapping or U.S.G.S. 7.5 minute series topographic maps or taken from reasonably accurate design data.

4. Dam Overtopping. Using given percentages of the PMF the computer program will calculate the percentage of the PMF which can be controlled by the reservoir and spillway without the dam overtopping.

5. Dam Breach and Downstream Routing. The computer program is equipped to determine the increase in downstream flooding due to failure of the dam caused by overtopping. This is accomplished by routing both the pre-failure peak flow and the peak flow through the breach (calculated by the computer with given input assumptions) at a given point in time and determining the water depth in the downstream channel. Channel cross-sections taken from U.S.G.S. 7.5 minute topographic maps were used in the downstream flood wave routing. Pre and post failure water depths are calculated at locations where cross-sections are input.

HYDROLOGY AND HYDRAULICS ANALYSIS
DATA BASE

NAME OF DAM: Stevens Lake Dam

PROBABLE MAXIMUM PRECIPITATION (PMP) = 22.2 (0.96) = 21.31 inches

STATION	1	2	3
Station Description	Stevens Lake Dam		
Drainage Area (square miles)	1.6		
Cumulative Drainage Area (square miles)	1.6		
Adjustment of PMF for Drainage Area (%)(1)			
6 hours	117		
12 hours	127		
24 hours	136		
48 hours	142		
72 hours	145		
Snyder Hydrograph Parameters			
Zone(2)	11		
Cp (3)	0.62		
Ct (3)	1.50		
L (miles) (4)	1.99		
Lca (miles) (4)	0.53		
tp = Ct(LxLca) 0.3 hrs.	1.52		
Spillway Data			
Crest Length (ft)	52		
Freeboard (ft)	4.7		
Discharge Coefficient	3.2		
Exponent	1.5		

(1) Hydrometeorological Report 40 (Figure 1), U.S. Army Corps of Engineers, 1965.
(2) Hydrological zone defined by Corps of Engineers, Baltimore District, for determining Snyder's coefficients (C_p and C_t).
(3) Snyder's Coefficients.
(4) L=Length of longest water course from outlet to basin divide. L_{ca}=Length of water course from outlet to point opposite the centroid of drainage area.

CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: DA=1.6 mi^2 gentle to moderate slopes

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 390 ac-ft

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): 737 ac-ft

ELEVATION MAXIMUM DESIGN POOL: 1057.0

ELEVATION TOP DAM: 1056.7

SPILLWAY CREST:

a. Elevation 1052.0
b. Type Modified sharp crest
c. Width 52 foot weir length
d. Length Unknown
e. Location Spillover Mid embankment
f. Number and Type of Gates None

OUTLET WORKS:

a. Type None
b. Location None
c. Entrance inverts None
d. Exit inverts None
e. Emergency draindown facilities Stop logs in weir

HYDROMETEOROLOGICAL GAUGES:

a. Type None
b. Location None
c. Records None

MAXIMUM NON-DAMAGING DISCHARGE: Unknown

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DAM NAME STEVENS LAKE DAM
I.D. NUMBER PA. 894
SHEET NO. 1 OF 3
BY OTM DATE 6-23-80

LOSS RATE AND BASE FLOW PARAMETERS

AS RECOMMENDED BY THE BALTIMORE DISTRICT CORPS OF ENGINEERS.

STRTL = 1 INCH
CNSTL = 0.05 IN/HR
STRTQ = 1.5 cfs/mi²
QRCSN = 0.05 (5% OF PEAK FLOW)
RTIOR = 2.0

ELEVATION-AREA-CAPACITY RELATIONSHIPS

FROM U.S.G.S. 7.5-MIN. QUAD., D.E.R. FILES AND FIELD INSPECTION DATA.

ELEV (FT)	AREA (AC)	AVG. AREA (AC)	ΔH (FT)	STORAGE (AC-FT)	ACC. STORAGE (AC-FT)
1035	0				0
		0.3	5	1.5	
1040	0.5				1.5
		12.2	5	61.0	
1045	23.9				62.5
		35.9	5	179.3	
1050	47.8				241.8
		73.9	10	739.0	
1060	100.0				980.8

SPILLWAY CREST ELEVATION = 1052.0
TOP OF DAM (LOW SPOT) = 1056.7
INITIAL STORAGE =

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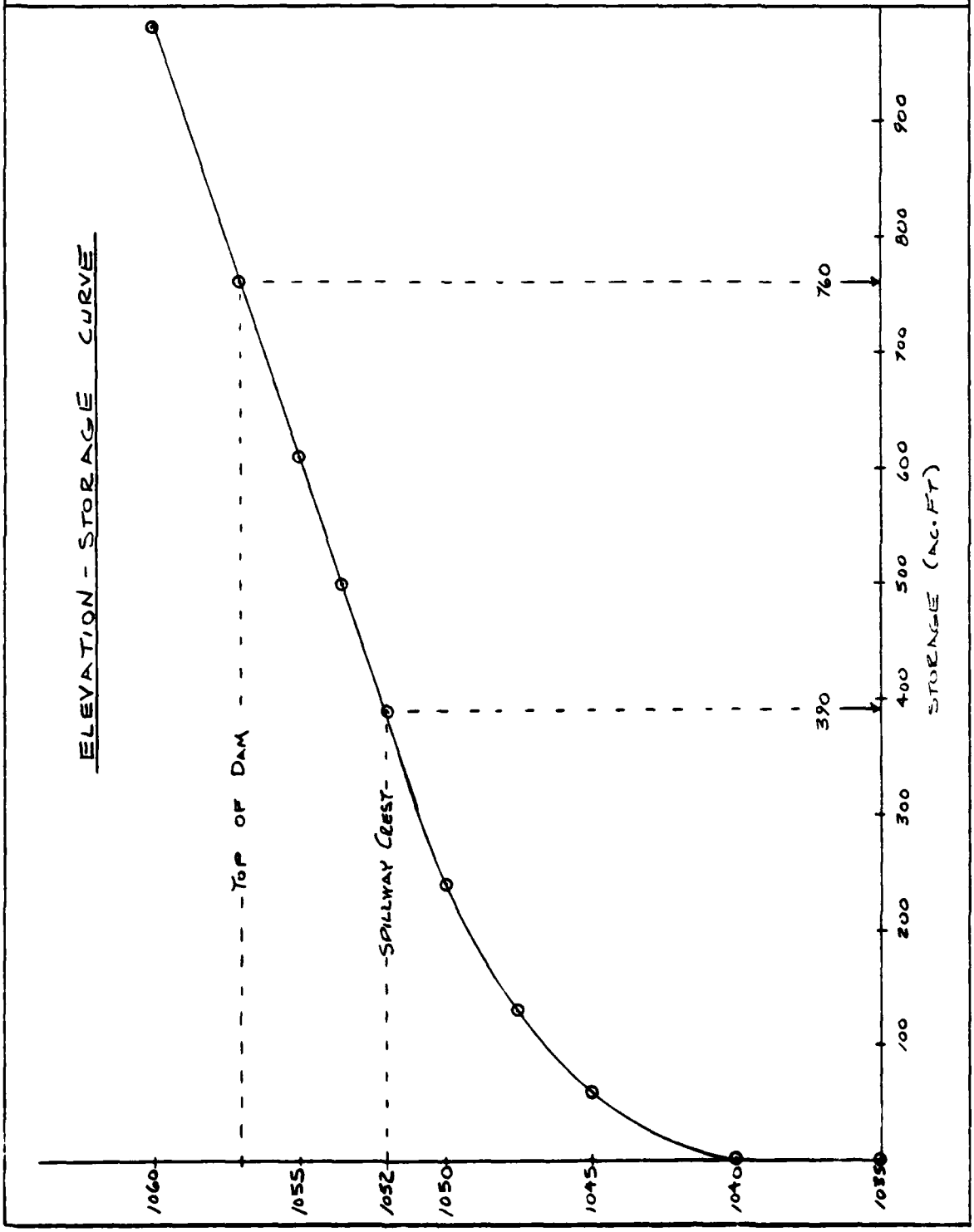
DAM NAME STEVENS LAKE DAM
I.D. NUMBER PA. 894
SHEET NO. 2 OF 3
BY OTM DATE 6-23-80



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DAM NAME STEVENS LAKE DAM
I.D. NUMBER PA. 894
SHEET NO. 3 OF 3
BY OTM DATE 6-23-80

DISCHARGE RATING CURVE

DETERMINED BY (HEC-1).

SPILLWAY CREST ELEV. = 1052
WEIR LENGTH = 52 FEET
COEFFICIENT OF DISCHARGE = 3.3

OVERTOPPING PARAMETERS

TOP OF DAM (LOW SPOT) = 1056.7
LENGTH OF DAM (EXCLUDING SPILLWAY) = 99'
COEFFICIENT OF DISCHARGE = 3.1 (BROAD CREST)
$LMAX = 135'
$YMAX = 1065

```
*****************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  26 FEB 79
*****************************
  1          AI      ANALYSIS OF DAM OVERTOPPING USING RATIOS OF PMF
  2          A2      HYDROLOGIC-HYDRAULIC ANALYSIS OF SAFETY OF STEVENS LAKE DAM
  3          A3      RATIOS OF THE PMF ROUTED THROUGH THE RESERVOIR (66-55)
  4          B    288      0      15      0      0      0      0      0      0      0
  5          B1     5
  6          J      1      3      1
  7          JI    .4     .5      1
  8          K      0      1                                    1
  9          K1       INFLOW TO RESERVOIR
 10          M      1      1    1.6                                                 1
 11          P           21.31    117    127    136    142    145
 12          T                                                1.0    .05
 13          W   1.52    .62
 14          X   -1.5   -.05    2.0
 15          K      1      2                                    1
 16          K1       ROUTE THROUGH RESERVOIR
 17          Y                                1      1
 18          Y1     1                                        -1052      0
 19          SS     0     60    130    240    390    500    610    760    980
 20          SE  1035   1045  1047.5   1050   1052  1053.5   1055   1057   1060
 21          SS  1052     52    3.3    1.5
 22          SD1056.7    3.1    1.5     99
 23          SL     3     10     25     50     80    117    125    135
 24          SV1056.7  1056.9  1057.0  1057.2  1057.5  1058.0  1060.0  1065.0
 25          K     99
```

```
*****************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  26 FEB 79
*****************************

RUN  DATE* 80/06/11.
     TIME* 13.52.27.

                    ANALYSIS OF DAM OVERTOPPING USING RATIOS OF PMF
                    HYDROLOGIC-HYDRAULIC ANALYSIS OF SAFETY OF STEVENS' LAKE DAM
                    RATIOS OF THE PMF ROUTED THROUGH THE RESERVOIR (66-55)

                                   JOB SPECIFICATION
              NQ    NHR   NMIN   IDAY    IHR   IMIN  METRC   IPLT   IPRT  NSTAN
             288      0     15      0      0      0      0      0      0      0
                                JOPER    NWT  LROPT  TRACE
                                    5      0      0      0

                          MULTI-PLAN ANALYSES TO BE PERFORMED
                              NPLAN= 1 NRTIO= 3 LRTIO= 1
              RTIOS=    .40    .50   1.00

*********         *********         *********         *********         **********

                          SUB-AREA RUNOFF COMPUTATION

                INFLOW TO RESERVOIR
                          ISTAQ  ICOMP  IECON  ITAPE   JPLT   JPRT  INAME ISTAGE  IAUTO
                              1      0      0      0      0      0      1      0      0

                                   HYDROGRAPH DATA
             IHYDG  IUHG  TAREA   SNAP  TRSDA  TRSPC  RATIO  ISNOW  ISAME  LOCAL
                 1     1   1.60   0.00   1.60   0.00  0.000      0      1      0

                                   PRECIP DATA
                      SPFE    PMS     R6    R12    R24    R48    R72    R96
                      0.00  21.31 117.00 127.00 136.00 142.00 145.00   0.00
TRSPC COMPUTED BY THE PROGRAM IS  .800

                                   LOSS DATA
          LROPT  STRKR  DLTKR  RTIOL  LRAIN  STRKS  RTIOK  STRTL  CNSTL  ALSMX  RTIMP
              0   0.00   0.00   1.00   0.00   0.00   1.00   1.00    .05   0.00   0.00
```

UNIT HYDROGRAPH DATA
TP= 1.52 CP= .62 NTA= 0

RECESSION DATA
STRTQ= -1.50 QRCSN= -.05 RTIOR= 2.00
APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC= 6.94 AND R= 5.53 INTERVALS.

UNIT HYDROGRAPH 33 END-OF-PERIOD ORDINATES, LAG= 1.51 HOURS, CP= .62 VOL= 1.00

26.	97.	192.	294.	378.	425.	426.	380.	317.	264.
220.	184.	153.	128.	107.	89.	74.	62.	52.	43.

HYDROGRAPH ROUTING

ROUTE THROUGH RESERVOIR

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
2	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	JOPT	IPMP	LSTR
0.0	0.000	0.00	1	-1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1052.	0

CAPACITY=	0.	60.	130.	240.	390.	500.	610.	760.	980.
ELEVATION=	1035.	1045.	1048.	1050.	1052.	1054.	1055.	1057.	1060.

CREL	SPWID	COQW	EXPW	ELEVL	COOL	CAREA	EXPL
1052.0	52.0	3.3	1.5	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
1056.7	3.1	1.5	99.

CREST LENGTH	3.	10.	25.	50.	80.	117.	125.	135.
AT OR BELOW ELEVATION	1056.7	1056.9	1057.0	1057.2	1057.5	1058.0	1060.0	1065.0

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 .40	RATIO 2 .50	RATIO 3 1.00
HYDROGRAPH AT	1	1.60	1	1868.	2335.	4670.
	(	4.14)	(	52.90)(	66.13)(	132.25)(
ROUTED TO	2	1.60	1	1286.	1659.	3999.
	(	4.14)	(	36.42)(	46.96)(	113.25)(

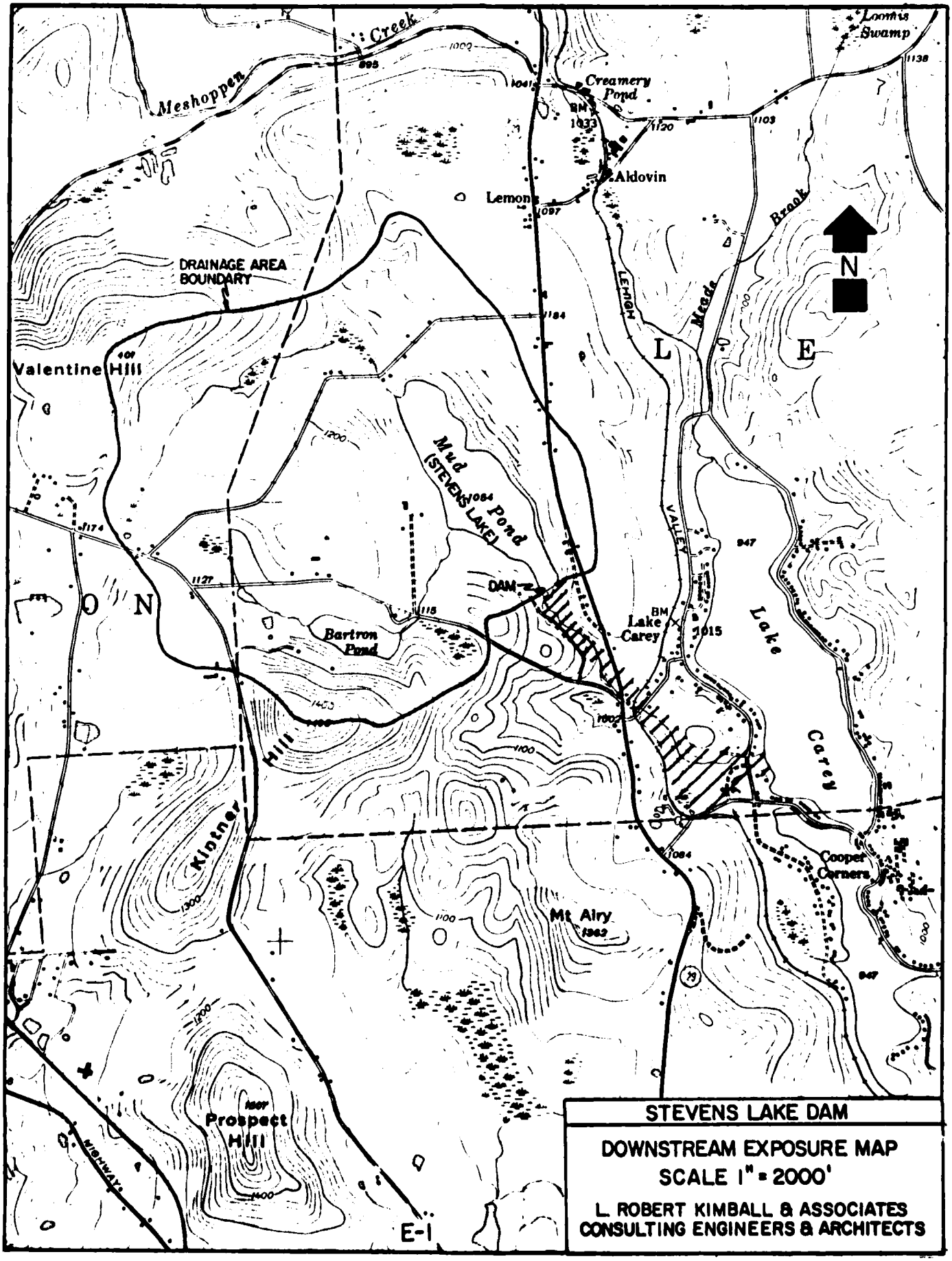
SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1052.00	1052.00	1056.70
STORAGE	390.	390.	737.
OUTFLOW	0.	0.	1748.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.40	1055.83	0.00	672.	1286.	0.00	42.50	0.00
.50	1056.54	0.00	725.	1659.	0.00	42.50	0.00
1.00	1059.01	2.31	908.	3999.	4.50	42.00	0.00

APPENDIX E
DRAWINGS



STEVENS LAKE DAM

DOWNSTREAM EXPOSURE MAP

SCALE 1" = 2000'

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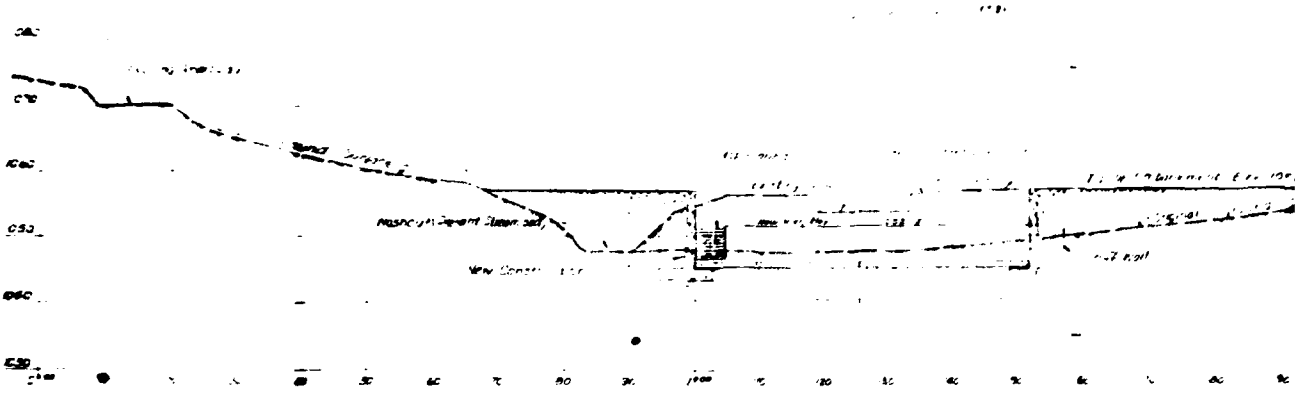
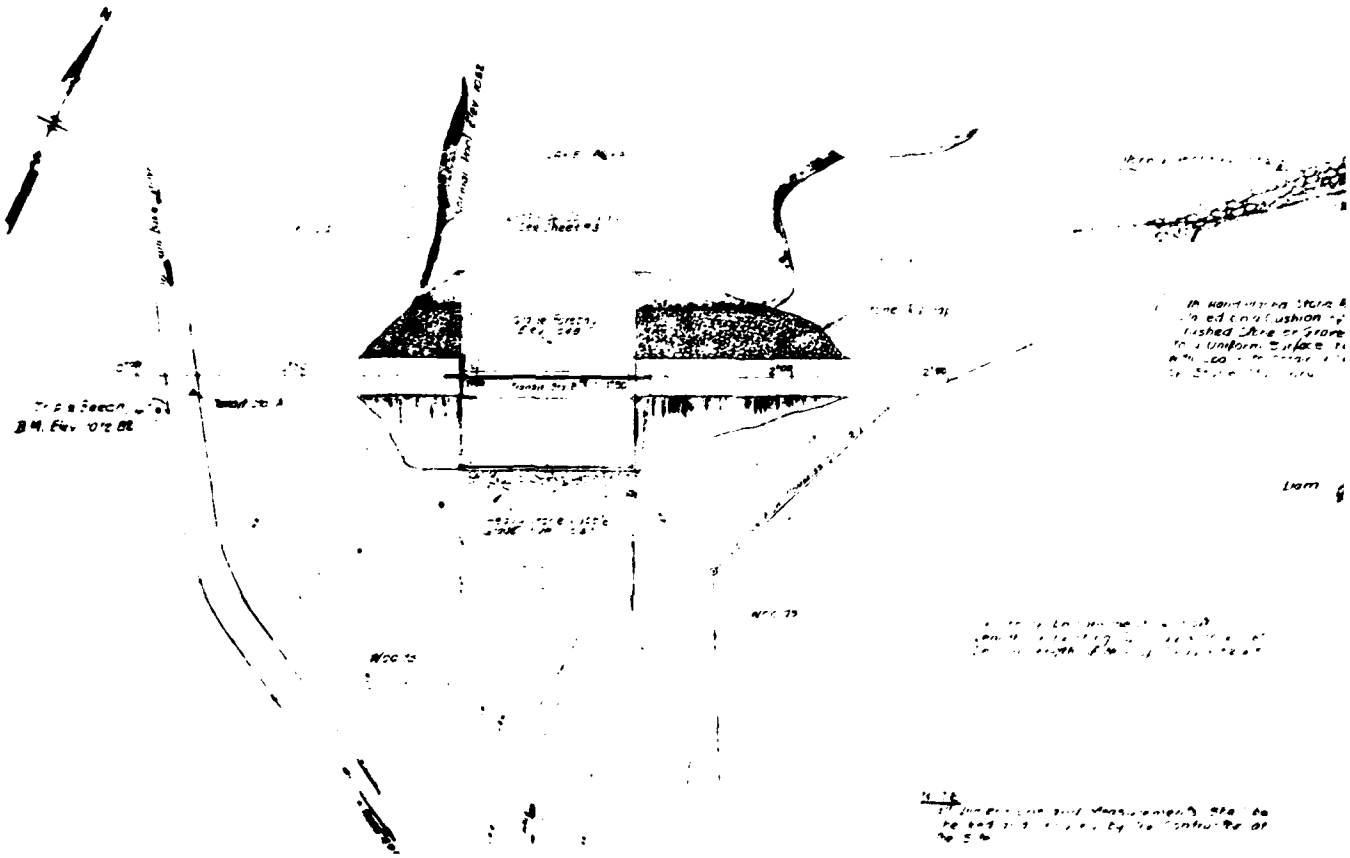
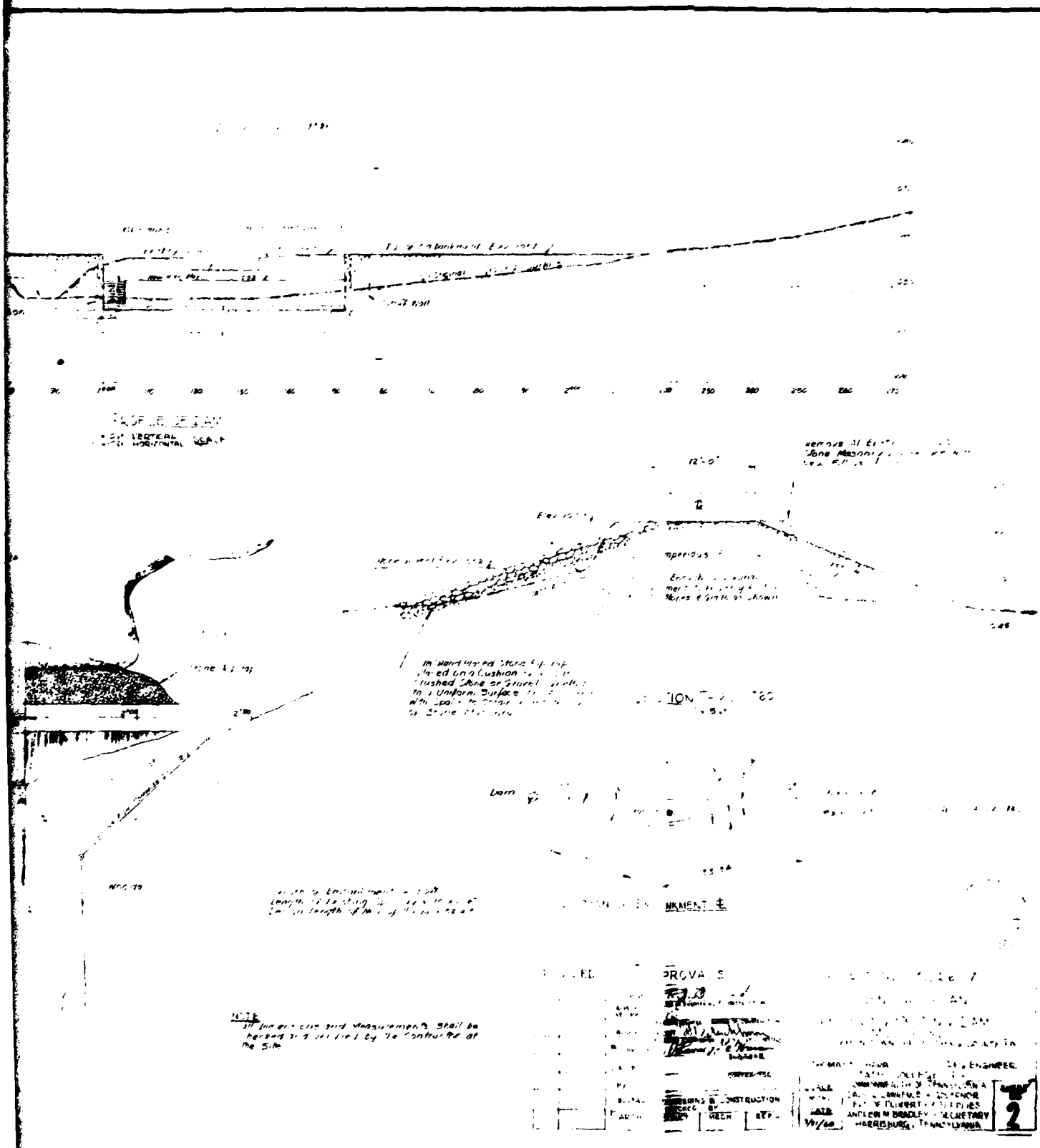




GENERAL PLAN



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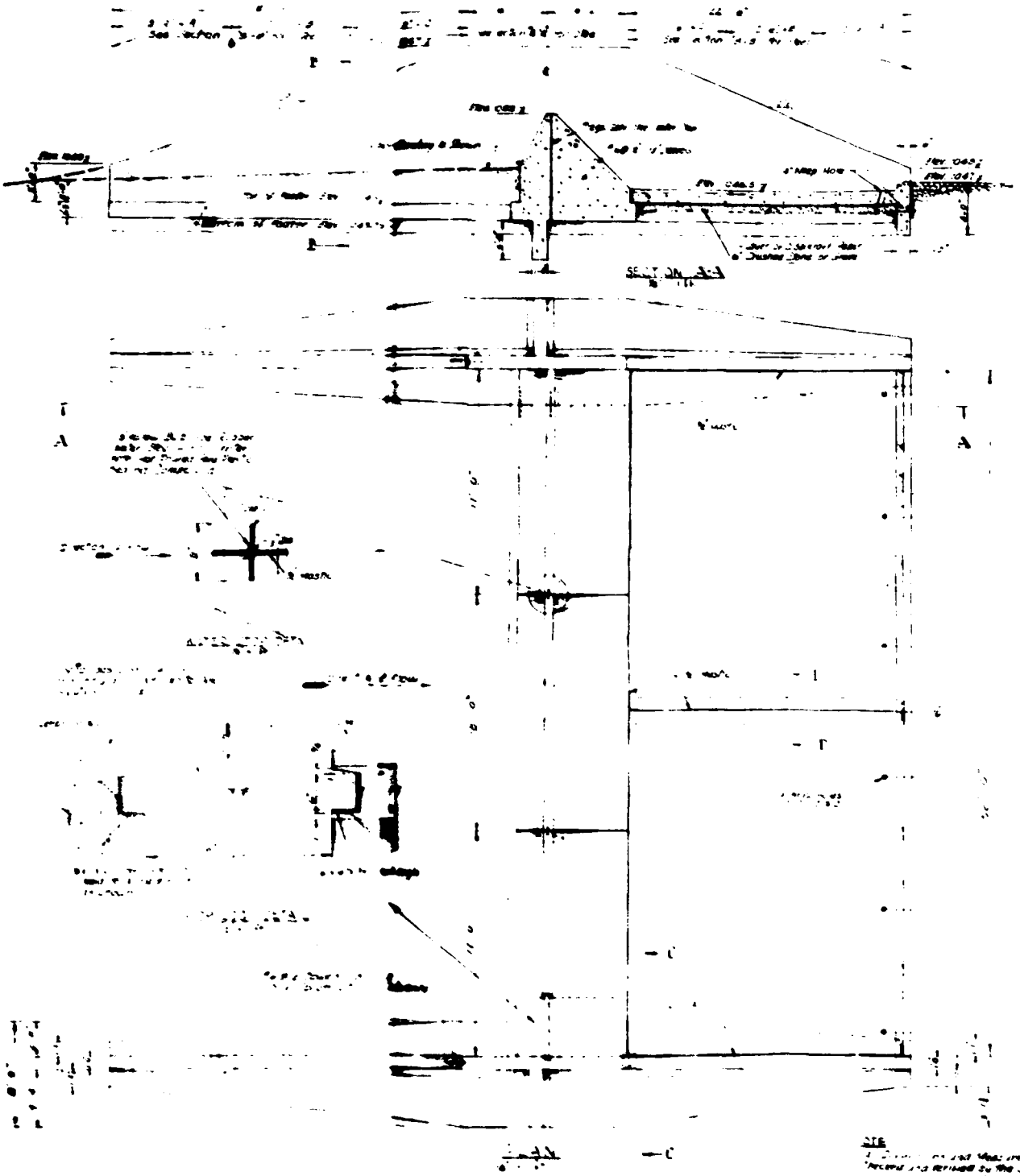

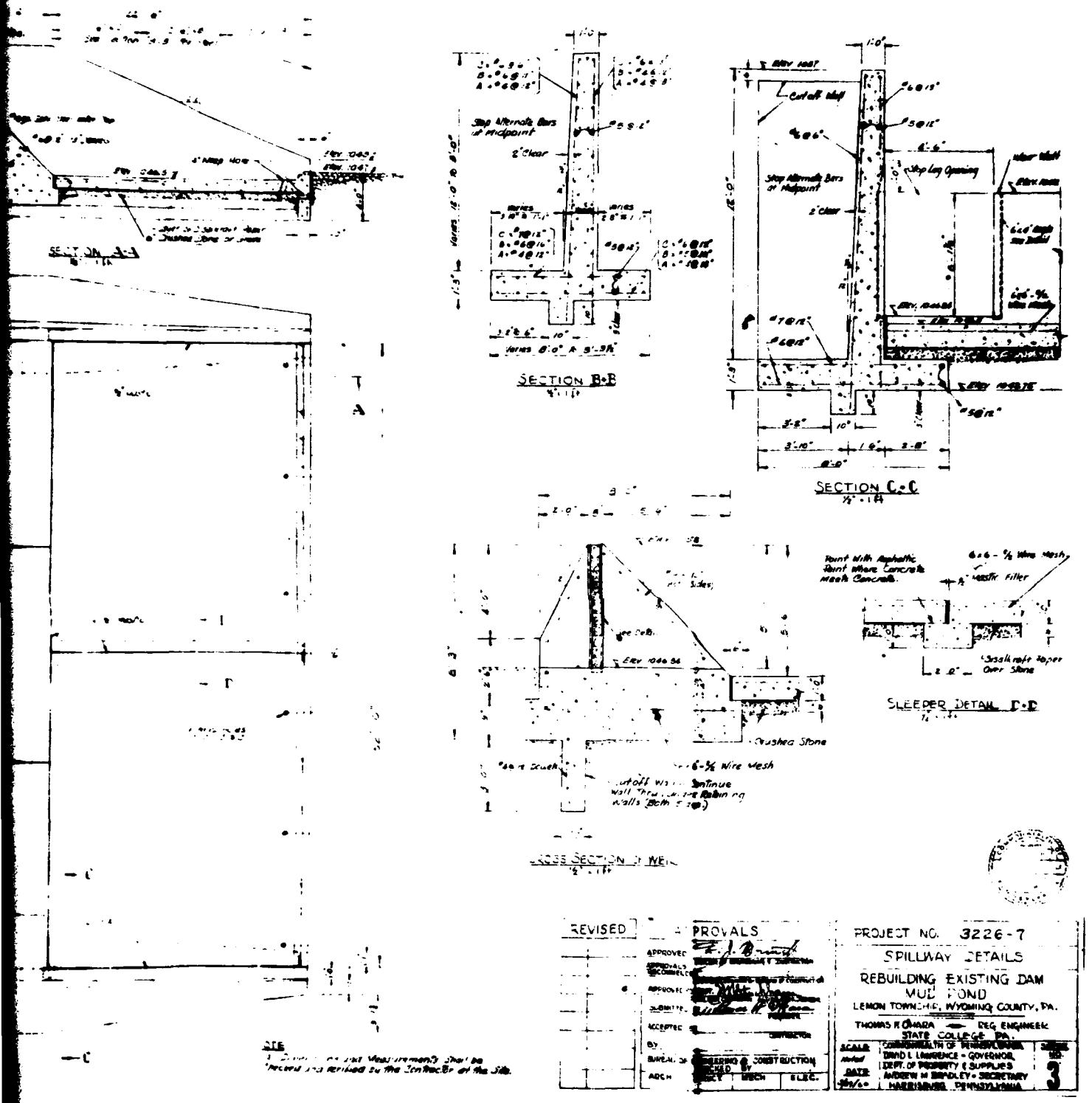

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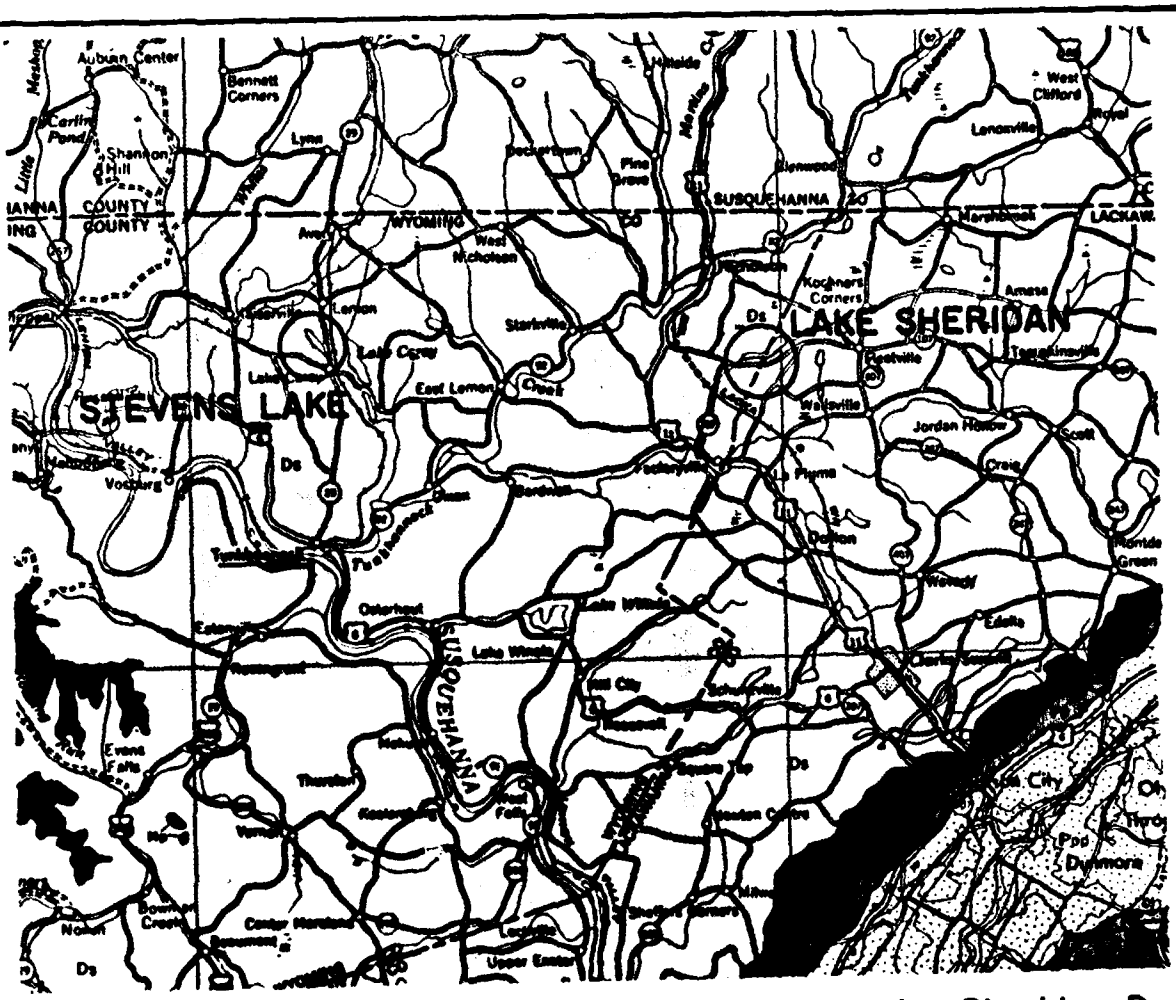
APPENDIX F
GEOLOGY

General Geology

Stevens Lake and dam lie within the (Glaciated) Low Plateaus Section of the Appalachian Plateaus Physiographic Province. This area is characterized by broad anticlines and synclines and little, if any, faulting. There are no known faults in the vicinity of the dam.

The rocks underlying the lake and dam consist of the Devonian aged Susquehanna Group. This is a complex unit of conglomerate, sandstone, siltstone and shale. The usually well developed bedding ranges in thickness from less to one to over fifteen feet. The well developed joints are regular and closely spaced in the shales and siltstones. They are vertical or steeply dipping and usually form a blocky or platy pattern. The shales disintegrate rapidly, but the siltstone, sandstone and conglomerate are fairly resistant to weathering. The rocks of the Susquehanna Group form a good foundation for heavy strucures if excavated to sound material and the shales and siltstones are kept water-free. The interstitial porosity of the coarser rocks is low, but joint development has created a medium level of total effective porosity.



Geologic Map of The Area Around Stevens Lake And Lake Sheridan Dams

CENTRAL AND EASTERN PENNSYLVANIA

Oswayo Formation
Brownish and greenish gray, fine and medium grained sandstones with some shales and scattered calcareous lenses; includes red shales which become more numerous eastward. Relation to type Oswayo not proved.

Dcs — **Catskill Formation**
Chiefly red to brownish shales and sandstones, includes gray and greenish sandstone tongues named Elk Mountain, Hancock, Shohola, and Delaware River in the east.

Dm — **Marine beds**
Gray to olive brown shales, graywackes, and sandstones, contains "Chemung" beds and "Portage" beds including Burket, Brallier, Harrell, and Trimmers Rock; Tully Limestone at base.

Ds — **Susquehanna Group**
Barbed line is "Chemung-Catskill" contact of Second Pennsylvania Survey County reports; barbs on "Chemung" side of line.

Scale: 1:250,000